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GEOPHYSICS, ASTRONOMY AND SPACE

No. 412

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GEOPHYSICS, ASTRONOMY AND SPACE

No. 412

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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I. ASTRONOMY

Abstracts of Scientific Articles

GEOEFFECTIVENESS OF OSCILLATIONS OF SOLAR SURFACE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 5, 1977 pp 930-932

[Article by A. V. Gul'yel'mi, B. M. Vladimirskiy and V. N. Repin, Institute of Physics of the Earth (Borok Geophysical Observatory) and Crimean Astrophysical Observatory, "Geoeffectiveness of Oscillations of the Solar Surface"]

[Abstract] The large-scale oscillations of the solar surface discovered in recent years have been explored in greater detail. These oscillations affect the entire solar surface and evidently are characteristic acoustic (p mode) and gravitational (q mode) solar oscillations. This phenomenon affords new possibilities for experimental study of the structure of the deep layers of the sun and is related to the problem of the geoeffectiveness of solar oscillations. It can be assumed that oscillations of the solar surface excite long-period magnetohydrodynamic waves in the interplanetary medium. Reaching the earth's neighborhood, the waves can cause modulation of the intensity of geomagnetic pulsations of the Pc3 type, whose spectrum is formed in front of the front of a circumterrestrial shock wave. The problem was studied using records of pulsations at Borok Observatory. A comparison of the position of the spectral peaks of the envelope of pulsation amplitudes with the known periods of solar oscillations indicates a rather close correspondence. A study was also made of the spectrum of fluctuations of the AE index. This spectrum was found to contain the periods of solar oscillations. (It is noted that under disturbed conditions in the spectrum of amplitude modulation of geomagnetic pulsations a contribution can be made not only by solar oscillations of a general nature, but also oscillations localized in active regions of the chromosphere and corona. It is not impossible that oscillations in the active region are genetically related to oscillations of the solar surface.) Thus, at the present time there is no clear interpretation of the discovered oscillations of the solar surface.
[107]

STRUCTURE OF ACOUSTIC-EDDY TURBULENCE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 236, No 5, 1977 pp 1112-1115

[Article by S. S. Moiseyev, Academician R. Z. Sagdeyev, A. V. Tur and V. V. Yanovskiy, Physical-Technical Institute, Ukrainian Academy of Sciences, "Structure of Acoustic-Eddy Turbulence"]

[Abstract] In earlier studies it was shown that in the inertial interval the spectral density of the energy of acoustons is proportional to $k^{-3/2}$. It has been determined that acoustic waves interact most strongly with almost collinear wave vectors and it can be assumed that there is a mechanism blurring the peculiarities of the amplitudes of higher-order processes. However, the problem of the specific means for determining the mentioned peculiarities remains open because in free acoustic turbulence acoustons can degenerate into sawtooth waves. In many cases eddies can be present in a compressible medium, in addition to acoustons, for example, in the excitation of turbulence by a random force having both potential and eddy components. Such acoustic-eddy turbulence frequently arises in different astrophysical problems. The authors have therefore further investigated the influence of eddies on acoustic turbulence, first examining degenerating eddy turbulence. In this case the pattern of motion of acoustic packets is extremely close to that which occurs in ordinary acoustic turbulence. It is shown that the spectrum $k^{-3/2}$ is correct not only in a region of weak turbulence, but also in a region of strong turbulence. The article also examines a case when the turbulence of eddies remains stationary, that is, has a Kolmogorov character. It is clear that in this case the effects of dispersion due to scattering on eddies are still greater than in degenerate turbulence. Also examined is the influence of the amplitude of eddies on the setting in of the $k^{-3/2}$ spectrum in the case of Kolmogorov eddy turbulence. A formula is given for finding the nonisotropic region in the $k^{-3/2}$ spectrum.
[81]

II. METEOROLOGY

Abstracts of Scientific Articles

INTERACTION BETWEEN OCEANIC-ATMOSPHERIC PROCESSES

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, GEOGRAFIYA in Russian No 5, 1977 pp 89-95

[Article by A. I. Duvanin, Oceanology Department, Moscow State University, "Interaction Between Hydrometeorological Macroprocesses in the Ocean and Atmosphere"]

[Abstract] In this review of the interaction between hydrometeorological macroprocesses in the ocean and atmosphere the author examines three subjects: Results of Statistical Analysis of Long-Term Observations. Results of Laboratory Modeling of Autooscillatory Mechanism in Interaction Between Macroprocesses in the Ocean and Atmosphere. Results of Numerical Modeling of Evolution of a Major Temperature Anomaly in the Process of Interaction Between the Ocean and Atmosphere. It is clear that there is a feedback determining the train of events: anomalous wind - anomalous drift current - change in temperature anomaly - change in wind field. It is necessary to take into account the temporal change in heat advection in the upper layer of the ocean due to transformation of the field of drift currents. Computations have confirmed the important role of variable drift currents in the propagation of heat anomalies. Without allowance for this time-variable component of the heat balance in the surface layer of the ocean or on the assumption of its constancy one obtains an unreal picture of transformation of the temperature anomaly. Allowance for the advection of heat by stationary currents has no great importance in the change in large temperature anomalies in the ocean. However, heat advection by the mean wind is quite important in this process. The principal pattern in the behavior of anomalies is an intensification of temperature variations of waters in the region of the subarctic hydrological front and movement of temperature anomalies primarily in an eastern direction.
[106]

III. OCEANOGRAPHY

Abstracts of Scientific Articles

KINEMATICS AND STRUCTURE OF CURRENTS IN NORWEGIAN SEA

Moscow OKEANOLOGIYA in Russian Vol 17, No 5, 1977 pp 769-773

[Article by V. G. Kort, V. B. Titov and A. S. Osadchiy, Institute of Oceanology, "Kinematics and Structure of Currents in a Polygon in the Norwegian Sea"]

[Abstract] During the period July-September 1975 an expedition of the Institute of Oceanology on the 21st voyage of the scientific research vessel "Akademik Kurchatov" carried out an extensive complex of hydrophysical studies in a polygon in the southern part of the Norwegian Sea, including prolonged (more than two months) current measurements. The polygon had the form of an equilateral triangle (length of sides 60 miles), at seven points within which long-term buoy stations with automatic current recorders were set out. The polygon was situated in a frontal zone between two main water flows -- the Norwegian Current on the east and the East Icelandic Current on the west. On the basis of the collected data the authors analyze aperiodic currents using measurements with a duration of two months. The authors note that there is a complex horizontal structure, a great spatial and temporal variability of the velocity field, characteristic of frontal zones. On the basis of the general directions of the currents at the measurement points it was possible to ascertain the kinematic picture of circulation of waters consisting of two conjugate eddies (cyclonic and anticyclonic), having a frictional origin. The eddies are generated and maintained in the quasistationary state of the Norwegian Current.
[109]

MORPHOSTRUCTURE OF CENTRAL PART OF MID-ATLANTIC RIDGE

Moscow OKEANOLOGIYA in Russian Vol 17, No 5, 1977 pp 829-836

[Article by G. B. Udintsev, V. M. Litvin, N. A. Marova, M. V. Rudenko, L. Ya. Budanova and P. A. Rona, Institute of Physics of the Earth and Institute of Oceanology, "New Data on Morphostructure of the Central Part of the Mid-Atlantic Ridge"]

[Abstract] This paper gives the results of geomorphological investigations in three polygons in the central part of the Mid-Atlantic Ridge between 8 and 27°N carried out on the 20th voyage of the scientific research vessel "Akademik Kurchatov" in 1975. The studies were carried out in regions of future boreholes: in the rift zone (polygon I), on the flank of the ridge, 100 miles to the east of the rift zone (polygon VI) and in the region of the trench of the transformed Vema fault (polygon II). There has been considerable refinement of the ridge structure in these regions. The article presents detailed bathymetric charts of the investigated regions and the bottom profile. It was possible to obtain records of numerous transverse faults along the eastern flank of the ridge. It was established that only some of them are transformed and divide the ridge into individual blocks. The remaining faults, having a similar cross-sectional form, do not have a significant extent, and being the result of differentiated vertical movements, serve only as the boundaries of individual mosaically arranged blocks. The results of the studies confirmed the nonuniformity of the structure of the Mid-Atlantic Ridge.
[109]

FIELD OF WATER DENSITY IN THE WORLD OCEAN

Moscow OKEANOLOGIYA in Russian Vol 17, No 5, 1977 pp 778-783

[Article by V. N. Stepanov, Institute of Oceanology, "Field of Water Density in the World Ocean"]

[Abstract] The author has now revised his now outdated investigation of water densities in the world ocean (see V. N. Stepanov, MIROVOY OKEAN. DINAMIKA I SVOYSTVA VOD, "Znaniye," Moscow, 1974). This new article gives completely revised maps based on data from all available oceanographic stations accumulated at the Institute of Oceanology and averaged by 5° grid squares. For the Atlantic Ocean there were approximately 100,000 stations, for the Pacific Ocean, 80,000, for the Indian Ocean, about 10,000. Figure 1 is a map of the density of surface waters; Fig. 2 is a corresponding map for the 200-m horizon; Fig. 3 is water density at 1,000 m; Fig. 4 is for the 4,000-m level. Each of these maps is briefly analyzed. For example, at the ocean surface densities below the average are noted in the tropical, and locally in the subtropical latitudes, in places where the waters are most heated. In the equatorial zone this is intensified by the low salinities. Here the minimum densities are observed, for the year averaging 1.02200-1.02100 g/cm^3. The maximum values are in the Antarctic, up to 1.02800. The thickness of the surface isopycnic layer varies from 10-20 to 40-50 m, locally attaining up to 100 m or more. Lower, in accordance with the marked restructuring of the temperature field, the density field completely changes. In the subsurface layer, at depths from 50-100 to 200-300 m, in places where subtropical anticyclones are situated, regions with a minimum density are created as a result of subsidence. In the equatorial

zone, in place of waters of reduced density there are waters which are denser due to their receipt from regions where tropical cyclones are situated. Thus, in the lower layer of surface waters in addition to the polar density maxima there is a secondary equatorial maximum. In the upper intermediate waters, similar to temperature, the density field changes little in comparison with the subsurface layer. This is attributable to the fact that the influence of the circulation of waters forming in the process of thermodynamic interaction between the ocean and the atmosphere is traced approximately to the core of the intermediate waters (situated in large part at depths from 600 to 1,000 m). In addition to the general pattern of increase in density vertically, it is possible to note the appearance of two secondary density maxima on either side of the equator; they are due to the upwelling of denser waters in tropical cyclones. This phenomenon is most clearly expressed in the Pacific Ocean.
[109]

STRUCTURE OF SEDIMENTARY STRATUM IN ARABIAN SEA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 237, No 2, 1977 pp 408-411

[Article by K. M. Babenko, V. A. Panayev and Yu. I. Svistunov, YuZhMORGEO Scientific-Production Combine, "Structure of Sedimentary Stratum in the Arabian Sea"]

[Abstract] Seismic investigations were carried out in 1975 aboard the expeditionary ship "Akademik Arkhangel'skiy" in the Arabian Sea. It was possible to ascertain the structure of the sedimentary stratum in virtually its entire thickness and determine its velocity characteristics. Three distinct horizons were detected and are described in detail. Among the findings were the following. The morphology of bottom crests and peaks, their interrelationship to the sedimentary layers, finds of basalts on individual peaks, increased values of the anomalous magnetic field, all indicate a volcanic nature of the ridges. In the central part of the Arabian Sea Basin the sediments lie virtually horizontally. The age of the sediments, judging from deep-water drilling data, range from the Paleocene to the Holocene. The thickness of the sediments gradually decreases in a southerly direction, in the direction of the mid-oceanic ridge, from 4.0 to 0.4-0.2 km. The presence of a number of petroleum deposits on the shores of the Arabian Peninsula, the discovery of large deposits in the Gulf of Oman and the presence of gas deposits in the Indian Ocean downwarp make it possible to consider the entire system of downwarps along the shores of the Arabian Sea to be promising for the discovery of petroleum and gas.
[101]

UNIVERSAL STRUCTURE OF ACTIVE LAYER OF OCEAN

Moscow OKEANOLOGIYA in Russian Vol 17, No 5, 1977 pp 774-777

[Article by O. V. Reshetova and D. V. Chalikov, Leningrad Division, Institute of Oceanology, "Universal Structure of Active Layer of Ocean"]

[Abstract] An effective method for constructing a pragmatic model of the active layer of the ocean is parameterization of the vertical distribution of density in the upper layer of the ocean. This is the method developed by S. A. Kitaygorodskiy and Yu. Z. Miropol'skiy, IZV. AN SSSR, FIZIKA ATMOSFERY I OKEANA, 6, No 2, 1970. But they assumed that the density of sea water is dependent only on temperature. This assumption already leads to errors in computing evolution of the active layer of the ocean in the middle latitudes and is known to be incorrect in the tropical regions where the principal contribution to density variations is from salinity. This article presents empirical data showing that the Kitaygorodskiy-Miropol'skiy approach can be generalized taking the influence of salinity into account. A method for taking salinity effects into account in prognostic models of the active layer of the ocean is presented.
[109]

DEVELOPMENT OF TURBULENT LAYER IN HOMOGENEOUS FLUID

Moscow OKEANOLOGIYA in Russian Vol 17, No 5, 1977 pp 784-790

[Article by V. S. Maderich and M. I. Zheleznyak, Institute of Hydromechanics Ukrainian Academy of Sciences, "Self-Similar Development of a Turbulent Layer in a Homogeneous Fluid"]

[Abstract] A study was made of the self-similar behavior of a finite layer of shear-free turbulence in a homogeneous incompressible fluid after application of an instantaneous turbulence source. The authors use a simple model consisting of two equations: for turbulent energy and for the dissipation rate. The solution of the problem belongs to a class of self-similar solutions of the second kind. There was found to be a significant dependence of layer parameters on the constants of the turbulence model.
[109]

VERTICAL STRUCTURE OF OSCILLATIONS IN OCEAN

Moscow OKEANOLOGIYA in Russian Vol 17, No 5, 1977 pp 800-805

[Article by A. V. Kulakov, USSR Hydrometeorological Center, "Numerical Method for Computing Vertical Structure of Oscillations in the Ocean"]

[Abstract] The author proposes a method for computing the vertical structure of small oscillations in a stratified ocean. In the numerical computations it was assumed that the ocean depth was 4,000 m and g = 9.81 $m \cdot sec^{-2}$. The article gives the results of computations of the first six eigencurves and eigenfunctions for internal gravitational waves. The computations were made using depth distributions of density, speed of sound and Väisälä frequency typical for the ocean. (Figure 3 shows the results of computations of the eigencurves for the first six modes of internal gravitational waves. Figure 4 shows the results of computations of the first six eigenfunctions for internal gravitational waves.) The method presented here made it possible to obtain the eigencurves and eigenfunctions for inertial-gyroscopic, acoustic and surface waves.
[109]

CIRCULATION CHARACTERISTICS IN ICELANDIC REGION

Moscow OKEANOLOGIYA in Russian Vol 17, No 5, 1977 pp 791-799

[Article by B. R. Zaripov and D. G. Rzheplinskiy, All-Union Scientific Research Institute of Marine Fishing and Oceanography and Institute of Oceanology, "Mean Long-Term Seasonal Circulation of Waters in the Northeast Atlantic, Norwegian, Greenland and North Seas (Diagnostic Computations)"]

[Abstract] Within the framework of the diagnostic model, a study was made of winter and summer circulation of the waters in the boundary regions of the Atlantic and Arctic Oceans. The authors examine the influence of the direct effect of the wind and the joint effect of baroclinicity and bottom relief on the formation of circulation. The seasonal variability of the currents is demonstrated. Fig. 1 shows the integral circulation in total flows, 10^5 $m^3 \cdot sec^{-1}$; Fig. 2 shows diagrams of winter and summer surface currents; Fig. 3 shows diagrams of winter and summer currents at 100 m; Fig. 4 shows corresponding maps for the 800-m horizon. The general pattern of circulation of waters in the investigated region is as follows: at the surface the velocity and direction of the currents for the most part are determined by the wind; the layer 50-500 m for the most part is characterized by a vertical uniformity of currents and by such well-known large-scale phenomena as the North Atlantic and Norwegian Currents, a cyclonic circulation in the Norwegian and Greenland Seas. At the surface the East Greenland Current is observed only in winter and in general is poorly expressed. It evidently for the most part is of wind origin... The motion of waters at deep horizons is for the most part directed southward and to a considerable degree is determined by bottom relief. The southerly direction of motion of deep waters in the investigated region corresponds to existing concepts. The reason for such motion is that at a depth of less than 1,000 m the waters of the Norwegian Sea differ from the waters of the Atlantic Ocean in having a considerably higher density...
[109]

NEW MAP OF EXOGENOUS GEOMORPHOLOGICAL FACTORS INFLUENCING OCEAN FLOOR

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. GEOGRAFIYA in Russian No 5, 1977 pp 82-88

[Article by O. K. Leont'yev, Geomorphology Department, Moscow State University, "Experience in Compiling a Schematic Map of Exogenous Geomorphological Factors Influencing the Floor of the World Ocean"]

[Abstract] The author has generalized data and concepts on the exogenous factors exerting an influence on the ocean floor and has compiled a corresponding map, a fragment of which, simplified and reduced to schematic form, accompanies the text. On the basis of the materials presented here, the author has compiled a legend for this map. It consists of three principal parts. In the first part the following types are discriminated: 1. Coastal and shelf terrigenous sedimentation. 2. Coastal, shelf and periisland calcareous, primarily biogenous sedimentation. 3. Abyssal terrigenous sedimentation. 4. Abyssal calcareous biogenous sedimentation. 5. Abyssal siliceous biogenous sedimentation. 6. Accumulation of red clays. (Symbols show sectors of volcanic and iceberg sedimentation.) The second part of the legend includes a list of the most important "hydrogenous" and gravitational factors and corresponding symbols: a) abrasional, transport and accumulative activity of sea waves, tidal and wind currents; b) erosional, transport and accumulative activity of turbidity currents and underwater slides and creep; c) erosional, transport and accumulative activity of bottom abyssal currents; d) transport activity of the most important surface geostrophic currents. The third section shows the most significant individual relief forms formed by the activity of some "hydrogenous" factors and turbidity currents.
[106]

IV. TERRESTRIAL GEOPHYSICS

Abstracts of Scientific Articles

CHARACTERISTICS OF POTENTIAL FIELDS IN SPACE OF THREE MEASUREMENTS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 10, 1977 pp 79-82

[Article by G. A. Troshkov, USSR Geology Ministry, "Problems in the Localization of Peculiarities of Potential Fields in the Space of Three Measurements"]

[Abstract] The method of localization of the peculiarities of plane-parallel geopotential fields has come into extensive use in the interpretation of gravitational and magnetic anomalies. In this paper it is shown that the three-dimensional problem can be solved by the same procedures as the two-dimensional problem. Specifically, it is shown that for determining the characteristics of the potential field it is desirable to use the method of localization of singularities [G. A. Troshkov, VOPROSY RAZVEDOCHNOY GEOFIZIKI, No 3, 1964; No 8, 1968]. This makes it possible, within the framework of the selected model, to obtain a solution satisfying the conditions of correct formulation of the inverse potential problem (in the A. N. Tikhonov-M. M. Lavrent'yev formulation). The problem is examined in the example of the vertical gradient of gravitational potential $V_z(x, y, z)$. Then the result is generalized for its other gradients and magnetic potential $U(x, y, z)$. The solution presented here allows generalization for other geophysical fields (stationary thermal, some types of electric and quasistationary electromagnetic fields, etc.). The proposed method is extremely convenient for realization in computer methods for the interpretation of geopotential fields.
[88]

ALLOWANCE FOR VARIATIONS OF THE EOTVOS EFFECT

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ZEMLI in Russian No 10, 1977 pp 83-86

[Article by L. A. Guvarenko, L. G. Ivankin, K. A. Kossova, V. S. Simakov and A. V. Staklo, All-Union Scientific Research Institute of Geophysics, "Allowance for Variation of the Eötvös Effect"]

[Abstract] Variations of the Eötvös effect have a broad spectrum; earlier studies have indicated variations with a period of one hour, 15-20 minutes, and others. This article describes automatic registry which has also made it possible to discriminate periods of 200-300 sec in these variations. The variations have a magnitude up to 2-3 mgal. It is particularly important to make a precise allowance for the Eötvös effect in a detailed gravimetric survey on the shelf. For example, in a survey at 1:200,000 one can expect to discriminate anomalies of 1-2 mgal and with an extent of 6-8 km (that is, with a period of about 15 minutes when the ship's speed is 12-15 knots). Thus, the characteristics of variations of the Eötvös correction coincide with the characteristics of the detected gravity anomalies. In the development of the MAGISTR gravimetric complex, in addition to registry of gravimeter readings in digital form, provision was made for the digital registry of the hyperbolic coordinates determined by phase-type radiogeodetic systems. Since the systems used in geophysics usually do not have an output in digital form, specialists at the All-Union Scientific Research Institute of Geophysics, in collaboration with the "Kazgeofizpribor" Plant, developed an analog-digital converter of radiogeodetic data which is useful in studying the Eötvös effect. Processing of the collected data is on an electronic computer and involves calculation of geographical and rectangular coordinates, computations, smoothing and input of the Eötvös correction into the gravimeter readings. Automatic registry and input of the Eötvös correction made possible a sharp reduction in manual work in the processing of shelf gravimetric measurements.
[88]

SEISMICITY OF THE REGION OF THE ZEYSKAYA HYDROELECTRIC POWER STATION

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 7, 1977 pp 3-8

[Article by V. P. Solonenko, V. V. Nikolayev, R. M. Semenov and A. D. Sarapulov, Institute of the Earth's Crust, "Seismicity of the Neighborhood of the Zeyskaya Hydroelectric Power Station"]

[Abstract] The article cited above examines the seismotectonic conditions of the seismically dangerous zone of the Zeyskaya Hydroelectric Power Station, whose dam is now being constructed in a narrow, canyonlike valley of the Zeya River. The history of seismic events and seismic research in this area is reviewed. The article is accompanied by a full-page map of neotectonics and seismically dangerous zones; this serves as a basis for much of the textual discussion. The investigations revealed that the greatest seismic danger for the future hydroelectric power station and reservoir will be from the Tukuringra-Dzhagdinskoye dome-block uplift, which is bounded by the Yuzhno-Tukuringskiy and Ust'-Gilyuyskiy faults. Each of these formations is discussed in detail.
[86]

CRUSTAL AND MANTLE INHOMOGENEITIES AND GRAVITY FIELD REDUCTION

Alma-Ata VESTNIK AKADEMII NAUK KAZAKHSKOY SSR in Russian No 10, 1977 pp 66-69

[Article by Ye. A. Zazubin and V. S. Bikeyev, "Lateral Inhomogeneities of the Earth's Crust and Upper Mantle and Gravity Field Reduction"]

[Abstract] The formal comparisons method used by most researchers in studies of crustal and mantle inhomogeneities does not make it possible to obtain reliable quantitative estimates of these inhomogeneities and therefore it is impossible to ascertain the degree of their participation in the overall gravitational effect observed at the earth's surface. The so-called "deep anomalies" method is more suitable. It involves exclusion from the observed gravity field of the influence of inhomogeneities of the structure of the earth's crust on the basis of a velocity-density model of the medium constructed using deep seismic sounding data. This article sets forth some of the basic points in the method and the results of such a reduction of the gravity field along the "Petropavlovsk-Issyk-Kul'" traverse, in a submeridional direction intersecting the territory of Kazakhstan along deep seismic sounding profiles ("Balkhash-Petropavlovsk" and "Kaskelenskiy"). The following conclusions were drawn on the basis of this study. 1. In the observed gravity field there is fullest reflection of inhomogeneities in the structure of the upper part of the earth's crust (above the Conrad discontinuity), causing a high-frequency spectrum of its local component. 2. Lateral inhomogeneities of the lower part of the crust (defects and excesses of mass caused for the most part by a change in the thickness of the basalt layer with relatively sustained values of its velocity-density characteristics) are not clearly reflected in the gravity field, to a considerable degree being compensated by a density redistribution in the upper mantle. Under these conditions there cannot be an unambiguous dependence between the gravity field observed at the earth's surface and individual crustal parameters.
[102]

SPATIAL OBSERVATION SYSTEMS IN REFLECTED WAVES METHOD

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 7, 1977 pp 95-107

[Article by S. V. Gol'din, Institute of Geology and Geophysics, Siberian Department USSR Academy of Sciences, "On the Theory of Spatial Observation Systems and Interpretation of Data Registered by the Reflected Waves Method"]

[Abstract] The author has examined elements of the theory of areal systems for observations of reflected waves. It follows from the simplest properties of the four-dimensional time field, giving a full description of the kinematics of a reflected wave for an arbitrary set of sources and receivers

in the observation plane that in solving various problems in spatial kinematic interpretation one can confine oneself to systems of observations of the profile type (such as orthogonal systems of profiles, a combination of "broad profile" elements, etc.). Also examined are some methods for solving the spatial inverse kinematic problem for curvilinear reflecting discontinuities.
[86]

CAUSE OF NEGATIVE MAGNETIC ANOMALIES IN OKHOTSK-CHUKOTKA REGION

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 7, 1977 pp 108-113

[Article by V. I. Kukhtin and Yu. G. Starnikov, Northeastern Technical State University, "Reason for Negative Magnetic Anomalies of the Vent Complex Within the Limits of the Okhotsk-Chukotka Volcanic Zone"]

[Abstract] When running aeromagnetic surveys in the Okhotsk-Chukotka zone specialists have observed unusual local negative anomalies whose intensity in individual cases attains several thousand millioersteds. The objects creating these anomalies are steeply dipping, isometric and oval in configuration, with a diameter in some cases attaining several kilometers. The anomaly-forming objects are usually observed amidst volcanic formations of an acidic composition of Upper Cretaceous age. Their spatial correlation with the fields of development of more basic volcanites is very rarely noted. Much information has been accumulated during more than a decade of study of anomalies of this type. It can now be said that there is a relationship between most of such negative magnetic anomalies and the centers of ancient eruptions located at different erosional levels. A specific example is considered. It is concluded that such anomalies are caused by reversely magnetized vent formations of Late Mesozoic volcanoes. The most probable reason for the formation of reverse polarity of these rocks is that they were formed under the influence of demagnetizing fields created by thermally magnetized country rock.
[86]

V. UPPER ATMOSPHERE AND SPACE RESEARCH

News

PLANS ANNOUNCED FOR CONDUCTING ROCKET LAUNCHES IN THE PACIFIC

Moscow IZVESTIYA in Russian 30 Nov 77 p 4

[TASS Report: "TASS Announcement"]

[Text] During the period from 1 December through 10 December 1977 the Soviet Union will conduct launches of booster rockets into a region of the Pacific Ocean bounded by a circle with a radius of 50 nautical miles with its center at the coordinates 48 degrees 24 minutes North Latitude and 162 degrees 53 minutes East Longitude and 39 degrees 40 minutes North Latitude and 166 degrees 30 minutes East Longitude.

TASS has been authorized to announce that for purposes of safety the government of the Soviet Union requests the governments of other countries using the sea and air lanes in the Pacific Ocean to instruct appropriate agencies so that ships and airplanes will not enter this region of the Pacific Ocean or the airspace above it in the afternoon from 1500 hours to 2400 hours LT.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-964"

Moscow PRAVDA in Russian 6 Dec 77 p 1

[TASS Report: "'Kosmos-964'"]

[Abstract] The artificial earth satellite "Kosmos-964" was launched in the Soviet Union on 4 December 1977. The satellite was inserted into an orbit with the following parameters:
-- initial period, 89.9 minutes;
-- apogee, 391 kilometers;
-- perigee, 180 kilometers;
-- orbital inclination, 72.9 degrees.

TASS ANNOUNCES LAUNCHING OF "KOSMOS-965"

Moscow PRAVDA in Russian 9 Dec 77 p 2

[TASS Report: "'Kosmos-965'"]

[Abstract] The artificial earth satellite "Kosmos-965" was launched in the Soviet Union on 8 December 1977. The satellite was inserted into an orbit with the following parameters:
-- initial period, 94.4 minutes;
-- apogee, 520 kilometers;
-- perigee, 469 kilometers;
-- orbital inclination, 74 degrees.

TASS ANNOUNCES LAUNCHING OF "SOYUZ-26"

Moscow PRAVDA in Russian 11 Dec 77 p 1

[TASS Report: "In Orbit -- 'Soyuz-26'"]

[Text] In accordance with the space research program, at 0419 hours Moscow time on 10 December 1977 the spaceship "Soyuz-26" was launched in the Soviet Union. The crew consists of flight commander Lt. Colonel Yuriy Viktorovich Romanenko and Flight Engineer, Hero of the Soviet Union and pilot-cosmonaut Georgiy Mikhaylovich Grechko. The ship was inserted into the calculated orbit.

The flight program of the "Soyuz-26" provides for the execution of joint experiments with the scientific station "Salyut-6," which was inserted into near-earth orbit on 29 September 1977.

The ship's on-board systems are functioning normally. The crew is in good health.

Cosmonauts Romanenko and Grechko have begun to execute the flight program.

***

By 1200 hours Moscow time the "Soyuz-26" spaceship had completed five orbits around the earth.

Since a flight trajectory correction, the orbital parameters of the "Soyuz-26" are:
-- apogee, 329 kilometers;
-- perigee, 267 kilometers;
-- period of revolution, 90.2 minutes;
-- orbital inclination, 51.6 degrees.

According to a crew report and telemetry information, the ship's on-board systems are functioning normally. Cosmonauts Romanenko and Grechko are in good health.

From 1200 to 2100 hours, when the spaceship "Soyuz-26" will be outside the zone of radio contact with the territory of the Soviet Union, the cosmonauts will rest. During this time the tracking of the flight and the reception of telemetry information from the spaceship will be carried out by the scientific research ships "Kosmonavt Yuriy Gagarin" and "Kosmonavt Vladimir Komarov" and transmitted to the flight control center via the "Molniya" communications satellite. [5]

BIOGRAPHICAL DATA GIVEN FOR COSMONAUTS

Moscow PRAVDA in Russian 11 Dec 77 p 1

[TASS Report: "Pages of Biographies"]

[Text] Lieutenant Colonel Yuriy Viktorovich Romanenko. Commander of the "Soyuz-26" spaceship Yuriy Viktorovich Romanenko was born in 1944 in the town of Koltubanovskiy in Buzulukskiy Rayon of Orenburgskaya Oblast.

In 1966 he graduated with honors from the Chernigov Higher Military Aviation School for pilots. He subsequently served as a pilot and instructor in the air force.

Yuriy Viktorovich has been a member of the Communist Party of the Soviet Union since 1965.

Yu. V. Romanenko was included in the team of cosmonauts in 1970. He took the full flight training course for the manned "Soyuz" spaceship and the orbital station "Salyut." In addition, he also prepared for the joint "Apollo-Soyuz" space flight as a flight commander.

Yuriy Romanenko is now a correspondence student with the Yuriy Gagarin Air Force Academy.

Georgiy Mikhaylovich Grechko. The "Soyuz-26" flight engineer Hero of the Soviet Union and pilot-cosmonaut Georgiy Mikhaylovich Grechko was born in 1931 in Leningrad. In 1955 he graduated with honors from the Leningrad Mechanical Institute and began to work at a design bureau.

G. M. Grechko proved to be an erudite engineer with initiative, participating in the development and testing of new space technology. He prepared and successfully defended a dissertation for the degree of Candidate of Technical Sciences.

In 1960 Georgiy Mikhaylovich joined the Communist Party of the Soviet Union.

G. M. Grechko was included in the team of cosmonauts in 1966. His great experience in engineering and profound theoretical knowledge permitted him to become excellently prepared for manned space flights and orbital stations.

G. M. Grechko completed his first space flight in 1975 as the flight engineer on the "Soyuz-17" transport ship and the manned orbital station "Salyut-4." [5]

PREFLIGHT COMMUNICATIONS TO FLIGHT CONTROL CENTER

Moscow PRAVDA in Russian 11 Dec 77 p 3

[Article by V. Gubarev: "The Red Point on a Map; Report from the Flight Control Center"]

[Text] On the information panel in the main hall at the Control Center the following words light up: "'Salyut-6' has begun its 1,135th revolution." The past two months for the specialists at the center have been filled with stressed work with the orbital station: it carries various kinds of scientific instrumentation and the duty officers have controlled the flight of this extremely complex extraterrestrial laboratory.

A half-hour later, not far from the green point moving across the screen, a red point lights up; the joint flight of the "Soyuz-26" and the station is beginning. But for the time being the cosmonauts are still on the earth.

Everything which is occurring at Baykonur is relayed to the Control Center.

"Switch for drainage!" sounds the familiar command.

"Everything on board is in order. Ready for the launching," reports Yu. Romanenko.

No, they are not going for a stroll in extraterrestrial space. Work. Hard, responsible work. And desired work.

"We are going into space because without man it will always be foreign and infinitely distant. We should make it 'terrestrial'... said the ship's engineer of the "Soyuz-26," G. Grechko.

They are excited in these seconds before the launching. Probably it would be strange and unnatural any other way.

"The pulse rate for the commander is 104, for the ship's engineer it is 112," reports the Center operator.

"We feel excellent!" immediately adds Yuriy Romanenko.

He calms the "Earth." And his voice is heard by thousands of people: at the cosmodrome, at the Center, at the observation-measuring points. Both cosmonauts know that in different corners of the country (the trajectory for putting the ship into orbit begins in Kazakhstan and ends over the Pacific Ocean) many people, known and unknown, are awaiting their launching, but they are infinitely close because they are all joined by a common purpose.

The two go into space... We see their faces. They are smiling at us, although at these minutes a firey squall is raging under their ship.

"The rocket trembles like a restive horse," this is the voice of the commander.

"Again at work," notes Georgiy Grechko. He repeats this phrase three times because it precisely expresses the sense of this launching.

"The vehicle is moving stably," comes the report from the commander. "Outside the little window for the time being there is nothing to see."

"Now a little sun is coming out..."

"The accelerations are insignificant and it is easy to tolerate them..."

"The red dot slides along the surface of the earth. Now the engine of the third stage is being shut down."

"Separation has occurred!"

The "Soyuz-26" is in orbit. And immediately the Center enters into communication with the cosmonauts.

"Taymyry," we congratulate you, says the flight director A. S. Yeliseyev. "Open to page seven of the program and we will go to work..."
[115]

Abstracts of Scientific Articles

COSMIC RAY ASYMMETRY IN EARTH'S MAGNETOSPHERE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 237, No 2, 1977 pp 288-290

[Article by N. K. Pereyaslova, M. N. Nazarova, I. Ye. Petrenko, S. I. Avdyshin and Yu. M. Kulagin, Institute of Applied Geophysics, "Effect of Asymmetry of Cosmic Rays in the High-Latitude Zones of the Earth's Magnetosphere"]

[Abstract] In investigations of the anisotropy of solar cosmic rays there was found to be an asymmetry (A) of background radiation, an asymmetry of galactic cosmic rays. This paper gives an analysis of the asymmetry observed in the registry of cosmic radiation in the polar regions from 1969 through 1977. Measurements of cosmic ray intensity were made in the high-latitude zones of the earth's magnetosphere (altitudes 700-900 km, invariant latitudes greater than 70°). Fluxes of protons with energies $E_p \geqslant 65$ MeV and $E_p \geqslant 90$ MeV were measured using scintillation detectors. Figure 1 shows the change in cosmic ray asymmetry during the period from March 1969 through May 1977. During the entire considered period there was S-N asymmetry in galactic cosmic rays whose value varied periodically from $\sim$-0.5 to $\sim$ -2%. (The most frequent temporal asymmetry variations were observed in 1976-1977.) Table 1, giving the parameters of the distributions for each year of observations, shows that in years close to the solar activity maximum the mean annual A values are greater. It was established that from the maximum to the minimum of the 20-year cycle there is a stable S-N asymmetry of cosmic rays. The maximum asymmetry was observed in 1971 when its absolute value was $\sim$3%.
[101]

ALTITUDE OF NIGHTTIME F2 REGION AND AERONOMIC PARAMETERS

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 5, 1977 pp 939-940

[Article by G. I. Ostrovskiy, Institute of Applied Geophysics, "Correlation Between the Altitude of the Nighttime F2 Region and Aeronomic Parameters"]

[Abstract] Up to the present time no investigation has yet made it possible to obtain an expression for h_mF2 at nighttime in explicit form. The author has now derived an expression which in explicit form gives the h_mF2 value in dependence on the parameters of the neutral atmosphere at some fixed altitude and the velocity of vertical drift

$$h_m = 40.2 \lg [O] + 38.9 \lg \beta + 10^{-2}w + 112,$$

where β is the coefficient of linear recombination and [O] is the concentration of atomic oxygen at an altitude of 300 km. The accuracy of the expression is $\pm$10 km. The formula is applicable for the middle latitudes in a time range whose limits are determined approximately an hour after sunset and an hour before sunrise. The use of this expression is illustrated in a practical example. It is shown that the deviations of computed data from experimental data do not exceed the measurement errors. The data presented here show that computations based on this expression adequately describe variations in the altitude of the maximum of the nighttime F2 layer in the middle latitude ionosphere and can be used for prognostic purposes.
[107]

GEOPHYSICAL EFFECTS OF SOLAR ACTIVITY IN UPPER ATMOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 5, 1977 pp 854-861

[Article by R. Knut and N. I. Fedorova, Electronics Institute German Academy of Sciences and Space Research Institute USSR Academy of Sciences, "International Coordinated Measurements of the Geophysical Effects of Solar Activity in the Upper Atmosphere. IV. Leakage of High-Energy Particles During the Time of a Baylike Disturbance of the Middle-Latitude D-Region of the Ionosphere"]

[Abstract] The authors have investigated a baylike absorption anomaly in the D region observed on 12 July 1970 at a time of moderate magnetic disturbance (K_p = 4) in the network of ground stations of the German Democratic Republic simultaneously with measurements of high-energy electrons on the satellite "Kosmos-348." These measurements were made during the second complex experiment carried out under the "Interkosmos" program. The measurements of baylike absorption were carried out by the A3 method in the range 150-245 KHz and took in the L-shells from L = 3 to L = 2 with reflection points falling in the region L = 2.72-2.50. Analysis of such bays indicated that they are poorly related to magnetic storms and can appear in different phases of a storm. They are rather uniformly distributed in local time and therefore cannot be a result of the transfer of particles injected at the time of a storm in a definite sector of local time. It is shown that the characteristics of this long-wave radio wave absorption bay can be satisfactorily attributed to additional ionization caused by an intensification of leakage of high-energy electrons at $L \geqslant 2.6$.
[107]

RELATIVE ION CONCENTRATIONS AT ALTITUDES 140-200 km

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 5, 1977 pp 847-853

[Article by L. A. Antonov and G. S. Ivanov-Kholodnyy, Institute of Applied Geophysics, "Computation of the Relative Concentrations of Ions at Altitudes 140-200 km for Specific Heliogeophysical Conditions. 1. Altitude 170 km, $[O^+]/n_e$"]

[Abstract] Computations of the relative concentrations of $[O^+]/n_e$ were made for an altitude of 170 km under specific heliogeophysical conditions in the middle latitudes. The practical purpose of the work was to obtain an algorithm for the most accurate possible computation of $[O^+]/n_e$ and a determination of the quantitative error. The computations can be made independently in two ways, empirically and theoretically; both of these approaches are discussed in detail. It is shown that with a combination of these approaches it is possible to obtain a more complete picture of the situation. As a point of departure the authors use data on short-wave solar radiation and the Jacchia model of the atmosphere with corrections for semiannual [O] variations and seasonal $[O_2]$ variations. The $[O^+]/n_e$ values were obtained with an accuracy to ±15%.
[107]

MODEL OF SINGLE-RAY SCANNING SYSTEM

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 10, 1977 pp 39-48

[Article by B. N. Rodionov, "Dynamic Model of Single-Ray Scanning System"]

[Abstract] The author proposes formulas for determining the geometrical essence of construction of a panoramic image of a single-ray scanning system. The article examines a general case when the survey apparatus is placed on a carrier which performs linear and angular motions and the scanning of object space is accomplished by rotation of the scanning ray about two axes. Special cases are also considered. Emphasis is on the most common variant of practical use of scanners -- terrain surveying from flightcraft. Among the subjects considered are the following: scanner as a projecting system, line-frame scanning, single-line linear scanning, conical scanning, geometrical model of a single-ray scanning system in image reproduction with a phototelegraph, geographical tie-in of orbital panoramas on the basis of a dynamic model of a scanner.
[103]

INVESTIGATION OF SOLAR X- AND GAMMA RADIATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 41, No 9, 1977 pp 1808-1818

[Article by A. V. Baskakov, Yu. G. Derevitskiy, A. G. Yenikeyev, G. Ye. Kocharov, G. A. Matveyev, A. S. Melioranskiy, V. O. Naydenov, A. A. Sementsov, Yu. N. Starbunov and Yu. Ye. Charikov, Physical-Technical Institute, "Investigation of Solar X- and Gamma Radiation Using RGS-1 Apparatus"]

[Abstract] The RGS-1 instrument for investigation of solar X- and gamma radiation is described in detail (Fig. 1 is a block diagram of the instrument and this serves as a basis for the textual discussion). The instrument was used on the satellites "Prognoz-4" and "Prognoz-5." Several registered events are discussed. On 26 December 1975 there was an increase in the intensity of X-quanta with an energy up to 100 keV. The total duration of one of the bursts was about one minute and the dropoff time was about 50 seconds. On 28 November 1976 there was an increase in the counting rate which lasted about 3 hours and 40 minutes; an intensity maximum was reached after 1 hour 20 minutes from the onset of the event. An extremely prolonged phenomenon was registered on 2 December 1976; the total duration was greater than 18 hours. Explanation of the observed phenomena requires that one postulate the presence of a source of heating of plasma because thermal conductivity cooling is a rather effective mechanism. Such variations in the particular range are characteristic for active regions in which flares can later occur. If this hypothesis is confirmed in a further analysis of collected data, some possibilities of prediction can appear. [This paper is from the materials of the 8th International Seminar "Active Processes on the Sun and the Problem of Solar Neutrinos," Leningrad 25-27 September 1976.]
[83]

SOLAR COSMIC RAYS AND INTERPLANETARY SHOCK WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 41, No 9, 1977 pp 1794-1807]

[Article by N. N. Volodichev, N. L. Grigorov, G. Ya. Kolesov, O. M. Kovrizhnykh, M. I. Kudryavtsev, B. M. Kuzhevskiy, V. G. Kurt, Yu. I. Logachev, N. F. Pisarenko, I. A. Savenko, A. A. Suslov, L. M. Chupova, V. F. Shesterikov and I. P. Shestopalov, Scientific Research Nuclear Physics Institute Moscow State University and T. Gomboshi, I. Kota and A. Shomodi, Central Research Institute of Physics, Hungarian Academy of Sciences, "Solar Cosmic Rays and Interplanetary Shock Waves 29-30 April 1973"]

[Abstract] The "Prognoz-3" satellite, launched on 15 February 1973 into an orbit with an apogee of about 32 R_E carried a large set of detectors for the registry of charged particles and solar X-radiation. On the basis of a great number of recorded events the authors have constructed a model of the structure of interplanetary space for explaining the events observed during the period 29-30 1973. (Figure 1 shows the increase in the fluxes of particles associated with the chromospheric flare of 29 April 1973; Fig. 2 shows the x-ray fluxes from this flare; Fig. 3 shows the mean 100-minute velocities of the solar wind measured aboard the satellite and the corresponding K_p index, etc.) The considered phenomena in particles discussed here in great depth give a clear example of the complex processes transpiring in interplanetary space. [This paper is from the materials of the 8th International Seminar "Active Processes on the Sun and the Problem of Solar Neutrinos," Leningrad 25-27 September 1976.] [83]

SOME ASPECTS OF MULTIZONAL SPACE SURVEYS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA. GEOGRAFIYA in Russian No 5, 1977 pp 28-35

[Article by Yu. F. Knizhnikov and V. I. Kravtsova, Aerospace Methods Laboratory, Moscow State University, "Method of Multizonal Space Surveying in Modern Investigations of the Environment"]

[Abstract] In the space experiments of recent years there has been extensive use of multizonal surveying, that is, surveying in different zones of the visible spectrum, having a number of advantages and disadvantages. There are several approaches to the interpretation of such multizonal photography, such as the selection of an informative zone; integrating the results of interpretation of photographs taken in all zones; synthesis of the colored images obtained in natural and fictitious colors; and analysis of the "spectral signature" of a particular object. The most effective use of a multizonal survey is in the exploration and mapping of shallow water areas and natural and agricultural vegetation.
[106]

ELECTRON DISTRIBUTION IN MORNING SECTOR OF MAGNETOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 17, No 5, 1977 pp 934-936

[Article by Z. G. Zuyeva, V. I. Lazarev and M. V. Tel'tsov, Nuclear Physics Institute, Moscow State University, "Position of the Region of the Auroral 'Break' of Electrons in the Morning Sector of the Ionosphere According to Measurements from the 'Molniya-1' Artificial Earth Satellite"]

[Abstract] Observations from the OGO-1 and OGO-3 satellites revealed a region of an auroral 'break' in the radial distribution of low-energy electrons. The spatial position and dynamics of the inner boundary of the plasma layer have been studied primarily in the evening and nighttime sectors of the magnetosphere. Information on the spatial distribution of electrons in the morning sector is inadequately complete. The "Molniya-1" was put into a high elliptical orbit with an apogee of about 40,000 km in the northern hemisphere and a perigee of about 500 km in the southern hemisphere with an orbital inclination of about 65°. The satellite carried an electrostatic spectrometer for measuring electron fluxes in four energy intervals. Measurements were made on 9, 16, 21 and 24 February 1975. On these days the satellite was favorably positioned for observations in the morning sector. For example, on 9 February at $L \leqslant 6$ there was a decrease in the energy density of electrons and the region in which during a magnetically quiet time there are no measurable electron fluxes was filled with an extremely strong plasma flow. The energy density of electrons at the distribution maximum had increased by a factor of about 5 in comparison with a quiet period and attained 10^{-8} erg·cm^{-3}. Thus, in the morning sector of the magnetosphere the inner boundary of the plasma layer $\varphi \sim 30°$ was discovered in a magnetically quiet time at a distance 4.5 R_E (L = 7). The position of the boundary and the energy density of electrons at the distribution maximum are closely associated with magnetic conditions in the polar region; an increase in magnetic disturbance is accompanied by an increase in the plasma flows on the auroral lines of force and a displacement of the plasma layer toward the earth.
[107]

GEOMETRIC PROCESSING OF IMAGES ON ELECTRONIC COMPUTER

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 10, 1977 pp 48-53

[Article by V. K. Zlobin, A. A. Anurkin and Yu. N. Kirilin, "Methods for Optimizing the Geometric Processing of Images on an Electronic Computer"]

[Abstract] In the automation of photogrammetric and cartographic work it is of particular interest to use electronic computers for the geometric rectification of aerospace images (their transformation, correction of

geometrical errors, making of photomosaics, etc.). However, the use of digital methods in actual practice is impeded by the great volume of information contained in such images. The article discusses methods for "rapid" geometrical transformations making possible a considerable acceleration of geometric processing and making possible solution of many practical problems on the basis of modern electronic computers. The article discusses the accuracy of the processing and the effectiveness of the algorithms in comparison with ordinarily used methods. The paper presents the experimental results of digital rectification of a large-scale aerial photograph.
[103]

NEW SPECTROMETER BASED ON SCINTILLATION DETECTORS

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 41, No 9, 1977 pp 1887-1898

[Article by E. M. Iovenko, A. L. Ioffe, A. K. Milovanov, V. N. Nikolayev, N. V. Smirnova and Ye. I. Yurevich, Leningrad Polytechnic Institute, "Spectrometer Based on Scintillation Detectors of Different Configuration for an Analysis of the Spatial Distribution of Gamma Fields"]

[Abstract] The computed dependences of counting rate and the directivity of scintillation detectors of different designs on angle and their good agreement with experimental data indicate the correctness of the design decisions made. The permeability of the partitions exerts a considerable influence on the steepness and range of linearity of the directivity characteristics of scintillation detectors. In the case of a cylindrical scintillation detector divided into two parts the range of change in $\Gamma(\varphi_0, \theta_0)$ decreases from 120° for the registry of gamma radiation from the isotope ^{241}Am to 60° for the isotope ^{132}Cs. The μR value of the scintillator exerts a similar influence. The use of alkaline-halide crystals as material for the scintillation detectors makes it possible to maintain the former directivity of the detector with an increase in the radiation energy, as indicated by the example of cylindrical and spherical scintillation detectors divided into four parts. A scintillation detector of a cylindrical configuration is an element suitable for measuring the azimuthal φ_0 angles. At the same time, the directivity characteristics of these scintillation detectors are complexly dependent on the angle θ_0. A scintillation detector of a spherical configuration makes it easy to determine both the angle θ_0 and the angle φ_0. It is easy to show that among two-channel systems spherical and cylindrical scintillation detectors divided into two parts are optimum in the range ±90° from the point of view of accuracy characteristics. It can be seen from a comparison of the counter-angle characteristics of scintillation detectors divided into two, three and four parts that the accuracy in measuring angles

increases with an increase in the number of partitions. [This paper is from the materials of the 8th International Seminar "Active Processes on the Sun and the Problem of Solar Neutrinos," Leningrad 25-27 Sep 1976.]
[83]

RECURRENT FLUXES OF LOW-ENERGY NUCLEI

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 41, No 9, 1977 pp 1819-1826

[Article by A. A. Kolchin, V. V. Lebedev, V. F. Levchenko, A. I. Repin, G. P. Skrebtsov and V. L. Shubin, Physical-Technical Institute, "Recurrent Streams of Low-Energy Nuclei (1-8 MeV/Nucleon) According to Measurements by the Automatic Station 'Prognoz-4'"]

[Abstract] Investigations of fluxes of low-energy nuclei ($\sim$1 MeV/nucleon) outside the earth's magnetosphere makes it possible to shed light on some processes transpiring on the sun and in interplanetary space. For making such measurements specialists at the Physical-Technical Institute have developed the AYaKS instrument, which in contrast to the ULET instrument, is a telescope of two silicon surface barrier detectors. The thickness of the first of these corresponds to the path of a carbon nucleus with an energy about 1 MeV/nucleon. The diameter of the sensing region of this detector and the angular aperture of the anticoincidence element surrounding the telescope made it possible to achieve a geometry factor of $\sim 1\ cm^{-2} \cdot sr$. The second detector is a lithium-drift detector. Both detectors are enclosed in the capsule of a plastic scintillator, which is oriented on a photomultiplier and which is cut into an anticoincidence circuit with silicon telescope detectors. This capsule determines the entrance aperture of the instrument and the upper limit of the measured nuclei. A table gives the ranges of registry and identification of particles with the AYaKS. The instrument was carried aboard the "Prognoz-4" automatic station launched on 22 December 1975 into an elongated elliptical orbit. Three events were registered. Each is analyzed in detail. The registry period was too short for drawing conclusions on the origin of nuclei in recurrent fluxes. However, the authors speculate on their possible origin. [The paper is from the materials of the 8th International Seminar "Active Processes on the Sun and the Problem of Solar Neutrinos," Leningrad 25-27 September 1976.]
[83]

PARAMETERS OF OBTURATOR SHUTTER OF SATELLITE CAMERA

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 10, 1977 pp 25-31

[Article by S. V. Tolbin and V. B. Kaptsyug, "Determination of Parameters of Obturator Shutter of AFU-75 Satellite Camera"]

[Abstract] At the present time AFU-75 cameras are used for observations of artificial earth satellites. The accuracy in computing the times of topocentric directions of satellites photographed using the obturator shutter is essentially dependent on the accuracy in determining the values of the instrumental constants of the camera, especially the parameters of orientation of the obturator shutter characterizing its position relative to the plane of the photograph. A method for determining these orientation parameters is given. These parameters correspond to an accuracy in determining the times of exposures to 0.1 msec in photographic observations. The design peculiarities of the shutter are examined in detail. The determined parameters agree with the theory of the obturator. Precise results are given. The most important parameters remain virtually constant in time.
[103]

LONGITUDINAL COMPONENT OF ERROR IN DETERMINING SATELLITE POSITION

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 10, 1977 pp 22-25

[Article by G. A. Ustinov, V. G. Tkachenko and V. G. Maksimov, "Longitudinal Component of Error in Satellite Position"]

[Abstract] The problem of the accuracy in determining orbital parameters is one of the most important in the theory of the orbital method of space geodesy. It is necessary to compare the accuracy in determining the radial, lateral and longitudinal components of errors in AES position and also to evaluate the accuracy in predicting the motion of the satellite beyond the limits of the measurement interval. The authors have investigated these matters using formulas cited in an article by G. A. Ustinov entitled "A Priori Evaluation of Accuracy and Optimum Conditions for Determining Orbital Parameters" (IZV. VUZov, GEODEZIYA I AEROFOTOS"YEMKA, No 4, pp 41-49, 1976). Particular attention is given to the change in the longitudinal component within the interval of the orbital arc containing the measurement. Satellite motion is examined in dependence on the distribution of measurements and the errors in the geopotential model. If it is necessary to obtain the orbital parameters most precisely in the measuring interval, an effort must be made to decrease it for lessening the influence of errors in determining the gravity field. On the other hand, if it is necessary to obtain the most precise prediction for a long interval, the measuring interval must

be lengthened. Naturally, in this case the accuracy is limited by the influence of geopotential errors on the orbital parameters, but at the same time one ensures a slow increase in the longitudinal component of the error in position of the AES. It is very important to take this conclusion into account in formulating satellite navigation algorithms for the purposes of geodetic support of studies for investigation of the earth's natural resources.
[103]

VI. MISCELLANEOUS

News

REPORT ON POLAR DRIFTING STATIONS

Moscow PRAVDA in Russian 21 Nov 77 p 2

[Article by Ye. Tolstikov: "Observatories on Ice"]

[Excerpts] Two stations, the "SP-22" and "SP-23," are operating near the pole on ice island-icebergs. The "SP-22" was organized on 13 September 1973 on an ice island at a point with the coordinates 76 degrees 16 minutes north latitude and 168 degrees 31 minutes west longitude. Over a period of four years the ice island has drifted 7,532 kilometers and is now situated in the region of the Canadian-Alaskan sector of the Arctic.

Twenty-one station specialists are carrying out a major complex of scientific observations. Twice a day aerologists carry out temperature-wind soundings of the atmosphere. A group of meteorologists in the field of actinometry is making observations of atmospheric pressure, air temperature, wind direction and velocity, cloud cover, precipitation, depth of the snow cover, state of the underlying surface and other atmospheric phenomena. Data on direct, scattered, reflected and total solar radiation are registered on the tapes of automatic recorders.

Professional oceanologists are investigating the variability of physicochemical characteristics of water masses in the Arctic Basin, the circulation of its waters, the structure of subsurface currents. They are also measuring depths in the drift region. Investigations are being made of these waters and hydrobiological studies are being carried out.

Specialists on the "SP-22" are studying the hydrochemical regime of the Arctic Basin, the chemical properties of the ice in dependence on age, structure and conditions of formation, distribution of traces of organic matter in the water, snow and ice, giving some idea concerning the degree of contamination of the environment.

A group of geophysicists is assigned the task of ionospheric observations of the absorption of radio waves. In addition, along the trajectory Moscow-"SP-22" the slant sounding method is used in investigating the propagation of short radio waves. This is necessary for a study of the upper layers of the atmosphere and the effect exerted on them by solar radiation, for solving practical problems in radio communications. Geophysicists are investigating the geographical distribution of the magnetic field and its variations.

Routine information from the "SP-22" drifting station is sent to the USSR Hydrometeorological Center, Arctic and Antarctic Institute, to stations along the Northern Sea Route, and also to the World Weather Center.

The "SP-23" drifting scientific research station was organized on 5 December 1975, also on an ice island to the north of Vrangel' Island. During the elapsed time it has drifted in a general north-northwest direction for 1,300 kilometers and is now located in the near-pole region.

At this station specialists are carrying out scientific observations in the field of actinometry, meteorology, oceanology and hydrochemistry in accordance with a program which is similar to that of the "SP-22." In addition to standard observations, the group of oceanologists is determining ice characteristics, processes of formation and destruction of drifting ice at the surface of the water and beneath it. The group is ascertaining and refining the relationships between the parameters of above- and below-water relief of ice of different kinds.

During forty years of operation the drift trajectories of the "Severnyy Polyus " stations have covered the map of the Central Arctic with a dense network. An analysis of these trajectories has made it possible to detect important patterns of ice drift in the ocean. For example, it has been established that in the Arctic Basin there are two principal major systems of ice drift: a transoceanic drift which occupies the part of the ocean between the pole and Eurasia and a circular anticyclonic circulation which occupies the space in the ocean adjacent to Greenland, the Canadian Arctic Archipelago and Alaska.

At the present time the "Severnyy Polyus-22" station has entered the anticyclonic drift. No other Soviet drifting station has passed along this trajectory with such a volume of observations. It is true that the "SP-2," "SP-8," "SP-11," "SP-12," "SP-16" entered the anticyclonic drift, but unfortunately, they were not able to complete their journey; the floes experienced numerous crackings. Now the "SP-22" is on an ice island measuring 5 x 2.2 km with an average thickness of about 30 meters and is supplied with everything necessary for continuing observations in accordance with the full program. It is difficult to overestimate the importance of the complex of scientific investigations along the trajectory of anticyclonic drift.

The hydrometeorological observations of the "Severnyy Polyus" stations and the oceanological surveys of the "Sever" expeditions helped in establishing that the hydrometeorological processes in the Arctic Basin from year to year experience considerable variations. In turn, they determine the large-scale, long-term changes in the ice regime and are dependent to a considerable degree on interaction with the Atlantic and Pacific Oceans. Observations on the "SP-22" will give more complete information on the hydrometeorological processes and the earth's magnetic field and will help to refine the limits of propagation of Pacific Ocean waters and the trajectory of anticyclonic drift. They will make it possible to obtain a quantitative estimate of the ice entrained in such drift. Finally, it can be surmised that the ice island on which the "Severnyy Polyus-22" station is situated will repeatedly duplicate the trajectory of anticyclonic drift and this will make it possible to judge the long-term variability of all these parameters. [105]

REPORT FROM POLAR STATION "SP-23"

Moscow PRAVDA in Russian 8 Dec 77 p 6

[Article by A. Yusin: "A Settlement Floats on an Iceberg"]

[Summary] The winter part of the high-latitude expedition "Sever-29" has been completed on the scientific research station "SP-23." Fuels and lubricants, equipment and food have been transported to the ice airfield. The iceberg has an area of more than 20 square kilometers. It is now drifting alongside the underwater Lomonosov Ridge. The "SP-23" is now the world's most northern settlement. It is 1 1/2 kilometers from the airdrome to the main street of the settlement. It took one month for the airdrome to be constructed. The "Sever-29" expedition was led by Mikhail Krasnoperov and the station chief is Vladislav Piguzov. Conditions are severe at the station; no one is allowed to wander off alone and flare guns are carried in case one should go astray. An extensive research program is planned for the coming year. For that reason the "Sever-29" and "Sever-30" expeditions were seemingly merged. The airmen of the Kolymo-Indigirka Aerial Enterprise are now dropping freight. With the first rays of the sun, in March 1978, plans call for establishing oceanological stations at 150 points in the Arctic Ocean. The "SP-23" in spring and summer will become a base from which hydrologists will make landings in different regions of the Arctic. The ice is 12 meters thick. Beneath it the ocean has a depth of 2,192 m. It is only 700 km from the geographic pole. A total of 5,680 meteorological reports have already been sent from the iceberg. In the future the ice islands may become floating bases from which man will have access to the wealth of the ocean. But it will be a long time before this happens. Electricity is changing the nature of life at arctic stations. For example, meteorologists no longer have to go outside to take instrument readings.

All this is done using automatic recording instruments located within laboratories. The specialists only monitor their operation, prepare meteorological summaries and prepare data which are processed by electronic computer. And then punched cards are sent to Leningrad for further study.

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